Networking Technology/Interoperability

Outputs

- Transportable equipment suite for network characterization and simulation.

- Automation for public safety audio quality testing facility.

ITS has a long history of assisting other agencies and organizations with their telecommunication planning, assessment, and interoperability studies, but the complexity of today's telecommunication and information technology (IT) requirements, and the technology available to satisfy those requirements, create demands for enhanced sophistication in the methodologies and tools used to perform these studies. The Networking Technology/ Interoperability projects have defined structured methods for such studies, examined many tools and techniques that can be used in conducting such studies, and identified those tools and methodologies most likely to provide the greatest benefits. Previous years' work focused on the selection and use of a suite of networking tools that aid in discovering the topology of

a network, the load on segments of a network, and the simulation of a network, as well as the development of a structured approach to applying these tools, along with a systems engineering method to address the complex issue of network interoperability. This past year's work focused on packaging and automating tools that can be used to implement the structured approach, resulting in two significant packages that can be used by ITS projects to meet the needs of their sponsors.

Network Characterization/Simulation Suite

Essential in determining how to get to where one wants to go is knowledge of where one is starting from. This is true of many things, including network and interoperability planning. In order to provide assistance in determining the current state of a network (i.e., network characterization), ITS has developed a suite of equipment that can be used to characterize networks of significant complexity.

The suite, housed in two shock-mounted equipment racks, can be shipped to a sponsor's site to provide network monitoring and analysis over a pre-determined time interval. It provides tools to perform four stages of characterization for networks: 1) discovery and analysis, providing a big picture of the network and identifying critical components; 2) network management and monitoring based on Simple Network Management Protocol (SNMP) for aggregate link analysis and determination of problem areas; 3) protocol analysis and application-specific monitoring for isolation of specific issues; and 4) simulation that can be used to re-create the network as-is and overlay new services and components to ensure any changes will meet the user's requirements. This high level process is shown in Figure 1.
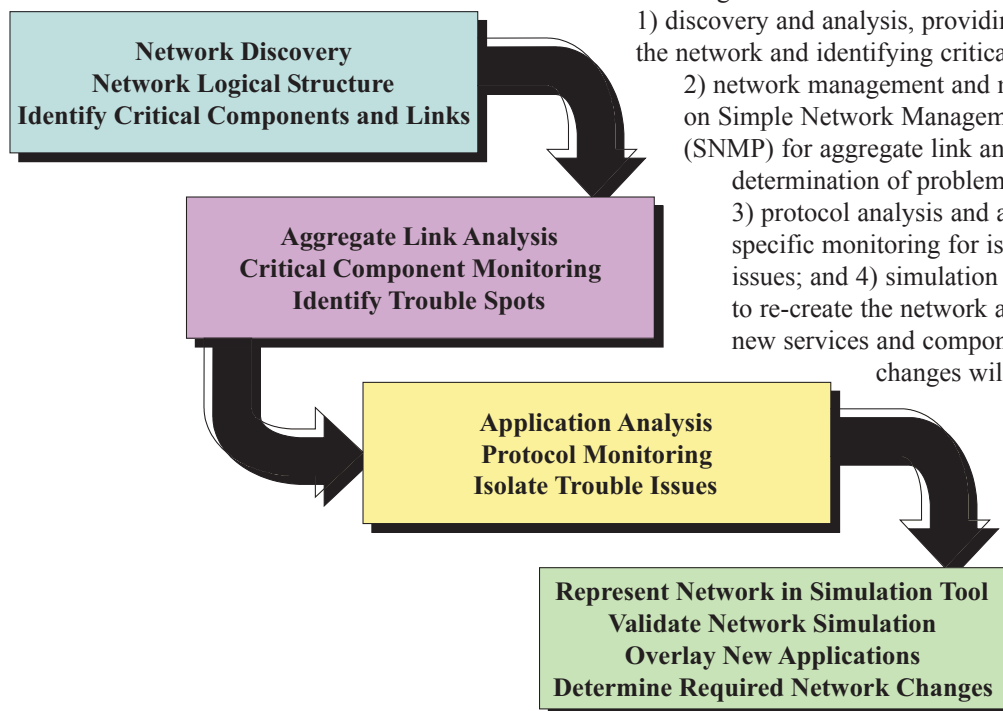

Figure 1. Network characterization process.

Figure 2. Public safety audio quality laboratory (photograph by D.J. Atkinson).

Public Safety Audio Quality Laboratory Automation

Determining the audio quality level that is required by public safety is complicated by several factors. Mixing different disciplines, environments, equipment types, frequency bands, and technologies greatly increases the number of communications variables for the public safety community. All of these factors need to be considered when it comes time to test a piece of communications equipment to determine if it provides adequate quality to the end user of the system. Further, these tests must be both accurate and repeatable.

In order to achieve this, and to support the Public Safety efforts within the division, this NTIA-sponsored program provided support to automate the public safety audio quality laboratory. The base of the audio laboratory is provided by two sound-attenuated chambers with full surround-sound capability to enable the emulation of the noise environments encountered by public safety practitioners. The sound mixing and distribution systems utilize 48 kHz digital audio (higher than CD quality) to ensure the fidelity of the testing, and the software-controlled digital mixing and recording system ensures that tests are reproducible. This is shown in

Figure 2. The public safety practitioners are represented by International Telecommunication Union (ITU) standardized Head and Torso Simulators (HATS). The HATS systems provide calibrated speakers to represent the mouth and calibrated microphones to represent the ears.

This project provided automation software to ensure tests conducted in the facility are accurate and reproducible, including calibration, level setting, and automated speech processing. Accurate calibration is essential when using acoustic coupling to a communications device, so the calibration feature allows the audio path to be accurately regulated (to within ± 0.2 dB). The ability to set and recall configuration and level settings for the mixer ensures that the audio path is unchanging from test to test. Finally, the analysis feature either allows digital recording of the output from the communications device for later analysis or will do immediate processing with the ITU-approved Perceptual Evaluation of Speech Quality (PESQ) objective audio quality measurement algorithm.

For more information, contact:
DJ Atkinson
(303) 497-5281
e-mail dj@its.bldrdoc.gov